RF Breakout

- The benefits of solid state RF amplifiers compared to klystrons/tubes.
  - No high voltage and low phase ripple
  - Inherent modularity and redundancy in the design.

- Balance between modularity and production costs.
  - Suppliers reduce modularity to improve production cost, but is it worth it?
  - SOLEIL chose to maintain modularity, even at a slightly higher cost allowing them to begin replacing 7-year-old transistors with updated transistors with higher gain and efficiency. Cost benefit resolution on the new transistors is 3 years.
    - The transistor technology is improving rapidly, driven by telecom and space industry.

RF Breakout

- Cost/Watt estimate
  - 350-500 MHz @ 100 kW cost is about 4.5 €/ Watt.
  - Cost/Watt increases as frequency increases and power decreases.
- Nuts and bolts
  - Redundancy and operation margin (10% on power) should reduce the need for hot swapping components.
  - Test stand, or spare could help eliminate the need.
  - Fully tunable power supplies can help optimization.
  - Failures are typically binary instead of slow degradation.

RF Breakout

- In house vs. suppliers
  - In house gives you experience and generates local knowledge
  - Suppliers could be depended on location.

- Future
  - Next 10 – 15 years CW with MW power needs will all be solid state.
    - Tube costs will increase as solid-state costs drops.
    - Klystron/tube high frequency and high pulsed power is still has benefits.
  - Many facilities are pursing solid state amplifier options.

RF Breakout

Thank you to the participants and RF experts

- Patrick Marchand
- Massamba Diop
- Robert Lopes